BRIEF SUMMARY OF THE INVENTION

Installation of Internally Resilient Ties in a ballasted track facilitates optimization of the dynamic track/train interaction regime according to a model illustrated on Fig. 6 to reduce track maintenance and to allow speed increases without costly deep soil replacements that are conventionally performed to remove naturally occurring variations of the track foundation. Unless the soils are exceptionally weak, this optimization is achieved by varying the spring rate of the bottom elastomer (6), by varying the mass of the independent block (2), and by choosing dimensions and materials of the assembly to provide high dynamic dampening.
One independent block (2) is placed under each rail (3) in a recess inside the tie case (1). The rail is attached to the independent block (2) by a threadless standard conventional fastener (7). The rail (3) is seated on a standard conventional elastomeric rail pad so that the mass of the block (2) is placed between two elastomers what results in its dynamic damper action. Dynamic forces corresponding to high frequency vibrations are abated by a standard rail pad of sufficient and constant hardness while the stiffness variations and nominal track stiffness adjustment of the assembly are performed at the elastomeric bottom pad (6) under the block in the context of the broader dynamic track/train interaction control. This feature has a potential of optimizing nominal stiffness of a track equipped with concrete ties and eliminating the increased track maintenance intensity experienced on continuously ballasted bridges and tunnel inverts.

The independent block (2) is prevented from being pulled out of the tie case (1) by block retainer assemblies (8 through 16) when the Internally Resilient Tie is lifted by rail (3) during track installation and maintenance. However, a small movement and elastic restrain are provided to facilitate rail float so that the intensity of track maintenance is reduced. The releasing and

retaining portion of the block retainer is thread-less to eliminate maintenance-intensive loosening of corroded threaded components.

A non-metallic collar (12) is attached on the top of the block (2) to provide a dry area under its overhang. Surface leakage of stray electric currents is thus interrupted.

Large enough masses of independent blocks (2) are used to facilitate absorption of significant portion of kinetic energy of environmental vibrations before the bottom elastomeric pad (6) is mobilized so that unprecedented levels of vibration insulation of ballasted track are available to solve relevant environmental way-side problems in populated areas.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Fig. 1 includes elevation, crossection and plan view of Internally Resilient Tie with Independent Booted Blocks and Concrete Case constructed in accordance with the present intention and for use on ballasted track.

Fig. 2 includes elevation, crossection and plan view of Internally Resilient Tie with Independent Booted Blocks and Steel Case constructed in accordance with the present intention and for use on ballasted track.

Fig. 3 includes Detail of Section I-I and block retainer assemblies cast in a concrete tie case.

Fig. 4 includes Detail of Section II-II and block retainer assemblies installed on a steel tie case.

Fig. 5 includes plan view relevant to block retainer assemblies.

Fig. 6 includes Dynamic Track/Train Interaction System – Model for One Axle

DETAILED DESCRIPTION OF THE INVENTION

The internally resilient tie is based on application of specialized design process of advanced dynamic track/train interaction analysis demonstrated in the enclosed report Upgrading Track and Roadbed for High Speed Operations by Jan H. Zicha, DTFR 53-00-P-00377, dated January 30, 2001. This process facilitates an expansion of the advantages of added controlled sprung masses of independent blocks to ballasted track. These advantages have been already demonstrated in the category of ballastless track types with independent booted blocks, such as Sonneville's LVT system that are exposed to different loading regime due to the presence of firm structural foundations. While the appearance of internally resilient tie is similar to prior art, it serves different function and the actual conditions of the track foundation and the nature of ballasted track are reflected in a different process of design, analyses and installation of sequentially installed internally resilient ties. Wherever foundation conditions vary, the unprecedented options to vary spring rates of the track by varying stiffness of the bottom elastomeric pad (6) with or without variations of the masses of the blocks (2) are available to bring about advantages described in the Background of Invention and Brief Description of the Invention.

Large components of the internally resilient tie have been described in the Abstract and Brief Description of the Invention and are apparent from enclosed Figures 1 and 2.

Block retainer (8) is attached to the concrete tie case (1) by its anchoring protrusion cast into the concrete of the tie case (1) shown on Fig. 1. Block retainer (16) is attached by bolted steel to steel connection to the steel tie case (1) shown on Fig. 2. Except for this connection, the block retainer is thread-less. Flat leaf springs (9) and (10) are inserted into a curved slot in a metallic insert (8) and (16). During installation, the lower leaf spring (9) is inserted first. Then

the upper leaf (10) is driven in. It deflects and causes the leaf (9) to deflect as well. The leaves (9) and (10) stay within the slot by thus introduced pre-load. An eventual shifting of the leaves that would loosen the plates is prevented by the pin (11) inserted into the aligned holes in the leaves (9) and (10) and in shoulders (8) and (16). The contact surface on the block's top (2) can be lowered or raised by inserting member (14) of an adjusted depth into the slot created by two members (15).